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RESEARCH BULLETIN

FURTHER STUDIES OF THE VALIDITY OF COMPONENTS OF THE U. S. NAVAL POSTGRADUATE SCHOOL TEST

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A Report to the Superintendent of the
U. S. Naval Postgraduate School

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FURTHER STUDIES OF THE VALIDITY OF COMPONENTS OF THE U. S. NAVAL POSTGRADUATE SCHOOL TEST

ABSTRACT

The U. S. Naval Postgraduate School Test, Form ZNP, was the outcome of a three-year research program carried out by Educational Testing Service for the Naval Postgraduate School. During this three-year period, three experimental batteries were developed and tried out at the School, with subsequent validation against criteria of academic success.

The operational test consists of Mathematics Aptitude, Advanced Mathematics, Physical Science and Engineering, Interpretation of Scientific Data, and Experimental Science sections. This report presents further information on the effectiveness of these sections for predicting success at the School, based on further validation of tests given in 1949 and 1950 which correspond to the sections of Form ZNP. (No direct validation of scores on Form ZNP is as yet possible, since at this date officers selected through its use have not yet entered the School.)

Two main outcomes of the study are (1) for the most part, results corroborate earlier findings as to test validity; and (2) the effectiveness of the tests given "in the fleet" in the fall of 1949 was considerably lower than when the same tests were given at the School.

FURTHER STUDIES OF THE VALIDITY OF COMPONENTS OF THE U. S. NAVAL POSTGRADUATE SCHOOL TEST

Introduction

In the period from May 1948 until June 1951 the Educational Testing Service carried out a research program for the U. S. Naval Postgraduate School; this research had as its purpose the development of measures that could be used as part of the means of selecting officers to be students at the School. Three experimental batteries were developed, tried out at the School, and subsequently validated against criteria of academic success at the School. The outcome of this research was the U. S. Naval Postgraduate School Test, Form ZNP, which was first put into operational use in the fall of 1951.

The present report deals with the further evaluation of the effectiveness of tests given during the research period which correspond to sections of Form ZNP.

Groups Followed-Up

In the present study sets of data for three groups were analyzed: (1) the group entering the School in 1949, for some of whom third-year grade data were available; (2) the group entering the School in 1950, for most of whom second-year grade data were available; and (3) a group tested in-the-fleet in the fall of 1950, for some of whom first-year grade data were at hand.

Findings

The validities of scores on six tests given to officers entering the School in 1949 for predicting third-year quality-point ratios (first two terms) are shown in six bar charts, Figures 1-6. Below the bar charts there are presented the mean and standard deviation of the test scores for the group, and the coefficient of correlation between test scores and third-year quality-point ratios.

These six figures and the correlations corresponding to them are based on too small a group of cases to draw any firm conclusions. Validities for these same six tests judged against first-year and second-year tests, presented in earlier reports, were substantial. While the bar charts for two of the tests, Advanced Mathematics and Engineering, apparently indicate appreciable positive relationships with the grades, none of the six correlations is statistically significant. (A correlation would have to be .46 or higher to be significantly different from zero at the 1% level for an N of 33.)

A striking picture is obtained when scores on six tests given in 1949 are related to the criterion of continuation or drop-out from the Postgraduate School for academic reasons. In Table 1 are presented the mean and standard deviation on these tests for 129 officers tested at the School following their entrance, together with the mean score for the six of these officers who were subsequently dropped from the School because of academic deficiencies. In another column of the table are given the biserial coefficients of correlation between test scores and the criterion of continuation vs. drop-out. The magnitude of these correlations is impressive; all are significantly different from zero statistically, there being far less than one chance in a hundred that correlations this large would occur by chance fluctuations in random sampling when the true correlation was zero.

Of the 158 officers tested in 1950 just after their entrance into the Postgraduate School, 129 have continued on for their second year at the School itself. Figures 6-11 indicate the relationships between five tests given this group (tests which correspond to the five sections of the operational test Form ZNP) and QPR. In each instance there is evident a substantial relationship between test score and the criterion of per cent of students with quality-point ratios of 2.0 or higher. Likewise, the observed correlation coefficients between scores on the various tests and quality-point ratio are all substantial. (All of these correlations are high enough so that they cannot be considered as mere chance deviations from a true value of zero.)

TABLE 1

Mean Scores of Academic Drop-Outs from 1949 Group,
Mean Soores for Entering Group, and Biserial Correlations
Between Scores and Criterion of Continuation in School

Test	Total Group N = 129		Academic Drop-Outs N = 6	Biserial Correlation
	Mean	S.D.	Mean	
1. Physics	51.9	12.7	32.2	.83*
2. Experimental Science	48.5	6.6	40.0	.62*
3. Mechanics	40.1	10.5	20.0	.92*
4. Advanced Mathematics	26.1	8.3	9.5	.96*
5. Interpretation of Data	23.1	5.5	14.8	.72*
6. Engineering	27.8	7.5	18.8	.57*

*A biserial correlation as high as this would occur by chance less than once in a hundred times when the true correlation was zero.

In the fall of 1950 four of the tests (which had also been administered that summer at the Postgraduate School in the last of the experimental batteries) were sent out to candidates applying for admission to the School, through the Bureau of Naval Personnel. Some 255 officers completed these tests, and scores were reported to the Postgraduate School and to the Bureau.

In Table 2 are shown the means and standard deviations on three of these tests which correspond to sections of the operational test, for three groups: (1) the 158 officers tested at the School in the summer of 1950; (2) 242 officers tested in the fleet; and (3) 80 officers from the fleet group who subsequently entered the School in the summer of 1951. It is readily apparent that the group entering the School (3rd group) constitutes a selection from the fleet group (group 2), since for each test the mean score for group 3 is significantly higher than the mean test score for group 2.

When applicants are selected on the basis of an effective predictor test score, the observed correlation between the predictor score and the criterion in the selected group is always lower than that which would have occurred had the scores not been used in selection. The bar charts in Figures 12-14 and the correlations stated beneath the charts must be interpreted in the light of this fact. While part of the observed drop in validity for each test is probably explainable as due to the effects of selection, it hardly seems possible that changes of the order of .40 can be accounted for in this manner. These tests when given at the School were considerably more effective than when given in the fleet; one must wonder whether this fact carries implications regarding the adequacy of testing conditions that can be secured "in the fleet."

TABLE 2

Comparative Data on Three Tests
for Fleet Group, 1950 Group, and 1951 Group

Test		(1) 1950 Group, Tested at School n = 158	(2) Fleet Group, Fall 1950 n = 242	(3) Group Entering in 1951, Tested in Fleet n = 80
1. Mathematics Aptitude WNPF	Mean	17.8	17.2	19.9
	S.D.	4.9	4.9	4.3
	r, 1st yr.	.60	---	.20
2. Physical Science and Engineering YNPA4	Mean	35.7	35.1	40.5
	S.D.	9.6	9.5	7.6
	r, 1st yr.	.56	---	.21
3. Advanced Mathematics YNPA1	Mean	20.6	15.3	19.3
	S.D.	6.9	7.4	7.8
	r, 1st yr.	.65	---	.19

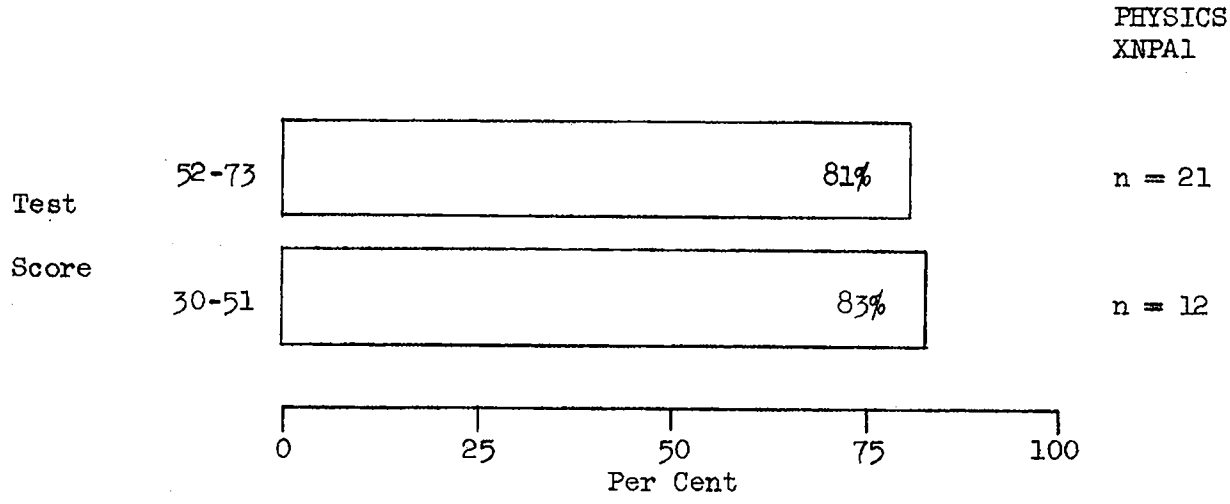

Figure 1. Per cent of students entering in 1949 in each of two score ranges on the Physics Test, XNPA1, with third-year quality-point ratios of 2.0 or above.
N = 33 Mean Test Score = 55.5 S.D. = 11.7 Test-Q.P.R. Correlation = .07

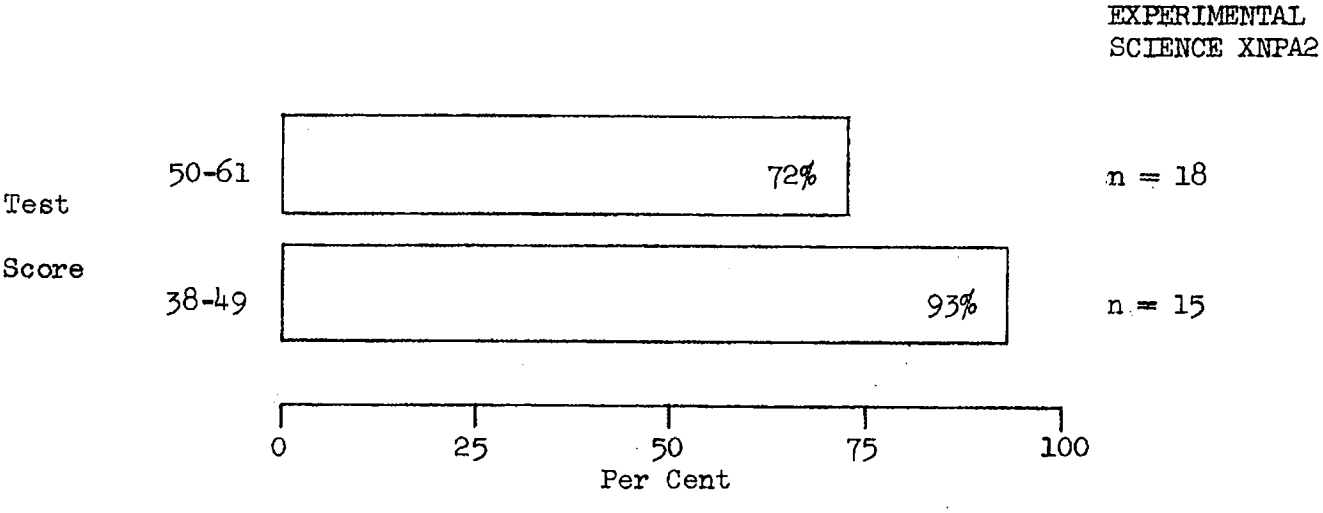

Figure 2. Per cent of students entering in 1949 in each of two score ranges on the Experimental Science Test, XNPA2, with third-year quality-point ratios of 2.0 or above.
N = 33 Mean Test Score = 50.3 S.D. = 4.4 Test-Q.P.R. Correlation = -.10

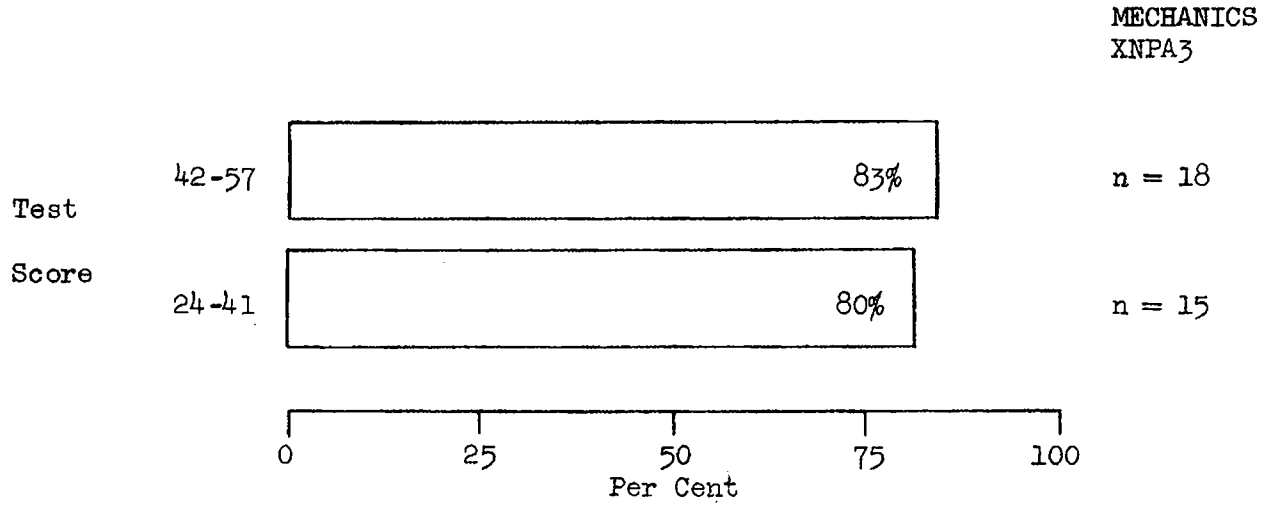

Figure 3. Per cent of students entering in 1949 in each of two score ranges on the Mechanics Test, XNPA3, with third-year quality-point ratios of 2.0 or above.
N = 33 Mean Test Score = 42.1 S.D. = 8.7 Test-Q.P.R. Correlation = .08

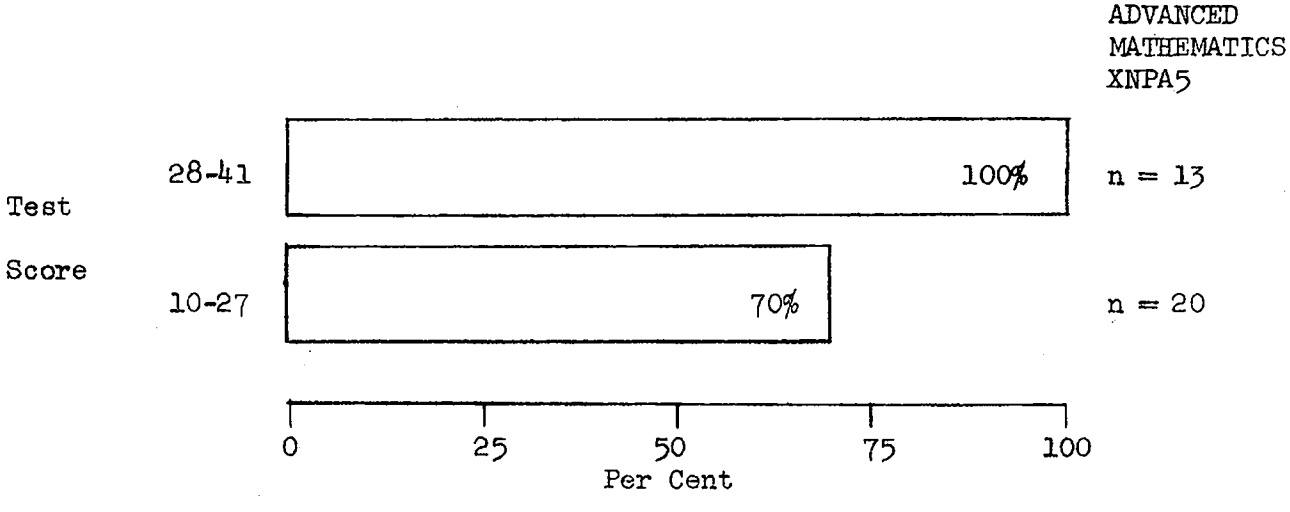

Figure 4. Per cent of students entering in 1949 in each of two score ranges on the Advanced Mathematics Test, XNPA5, with quality-point ratios of 2.0 or above.
N = 33 Mean Test Score = 25.7 S.D. = 6.3 Test-Q.P.R. Correlation = .21

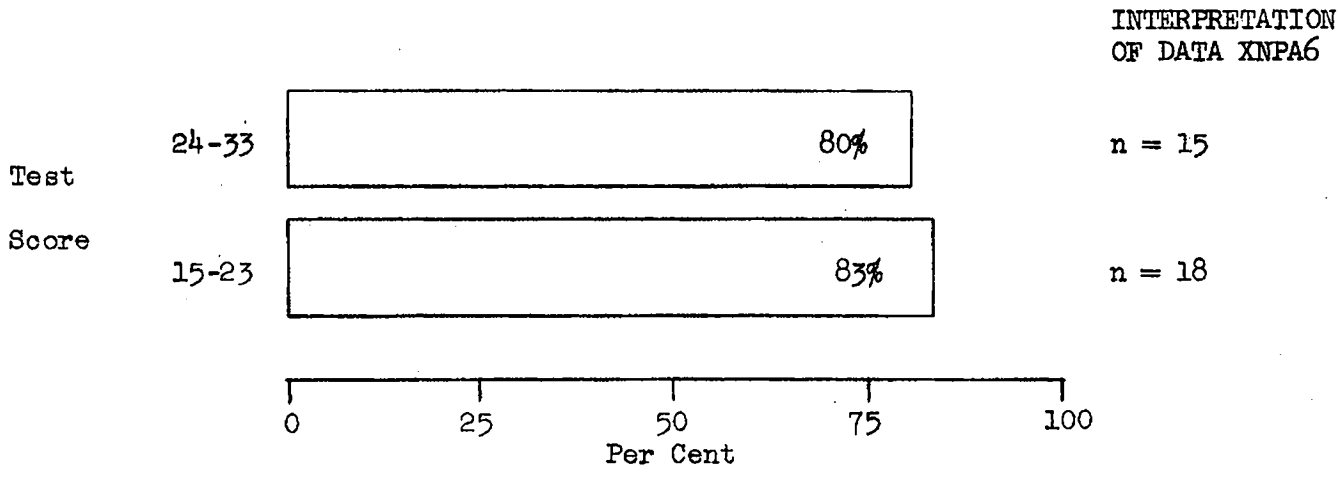

Figure 5. Per cent of students entering in 1949 in each of two score ranges on the Interpretation of Data Test, XNPA6, with third-year quality-point ratios of 2.0 or above.
N = 33 Mean Test Score = 23.7 S.D. = 4.7 Test-Q.P.R. Correlation = .08

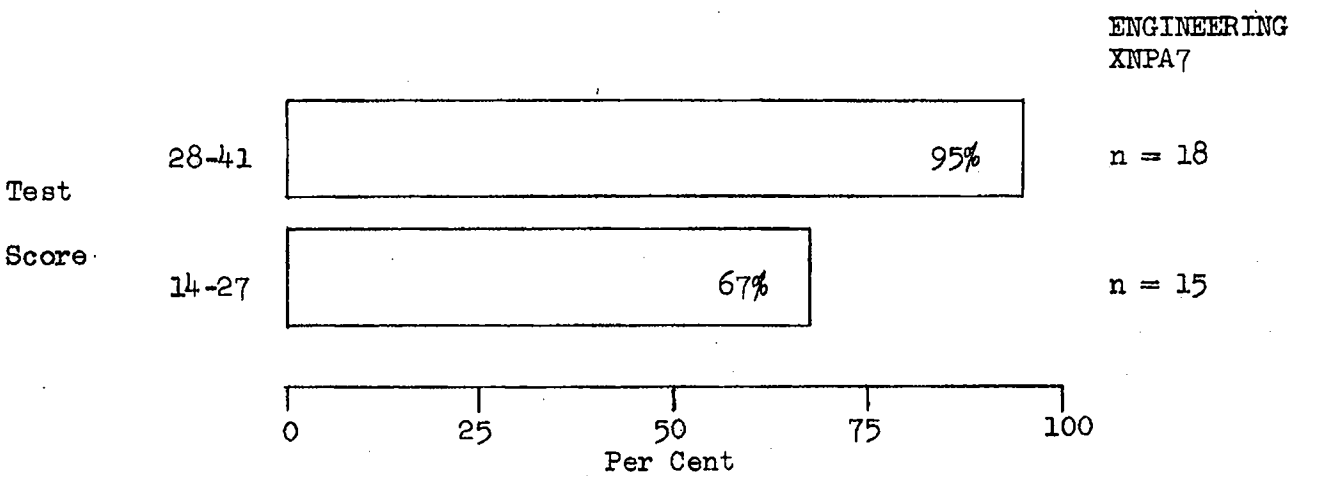

Figure 6. Per cent of students entering in 1949 in each of two score ranges on the Engineering Test, XNPA7, with third-year quality-point ratios of 2.0 or above.
N = 33 Mean Test Score = 29.2 S.D. = 6.9 Test-Q.P.R. Correlation = .28

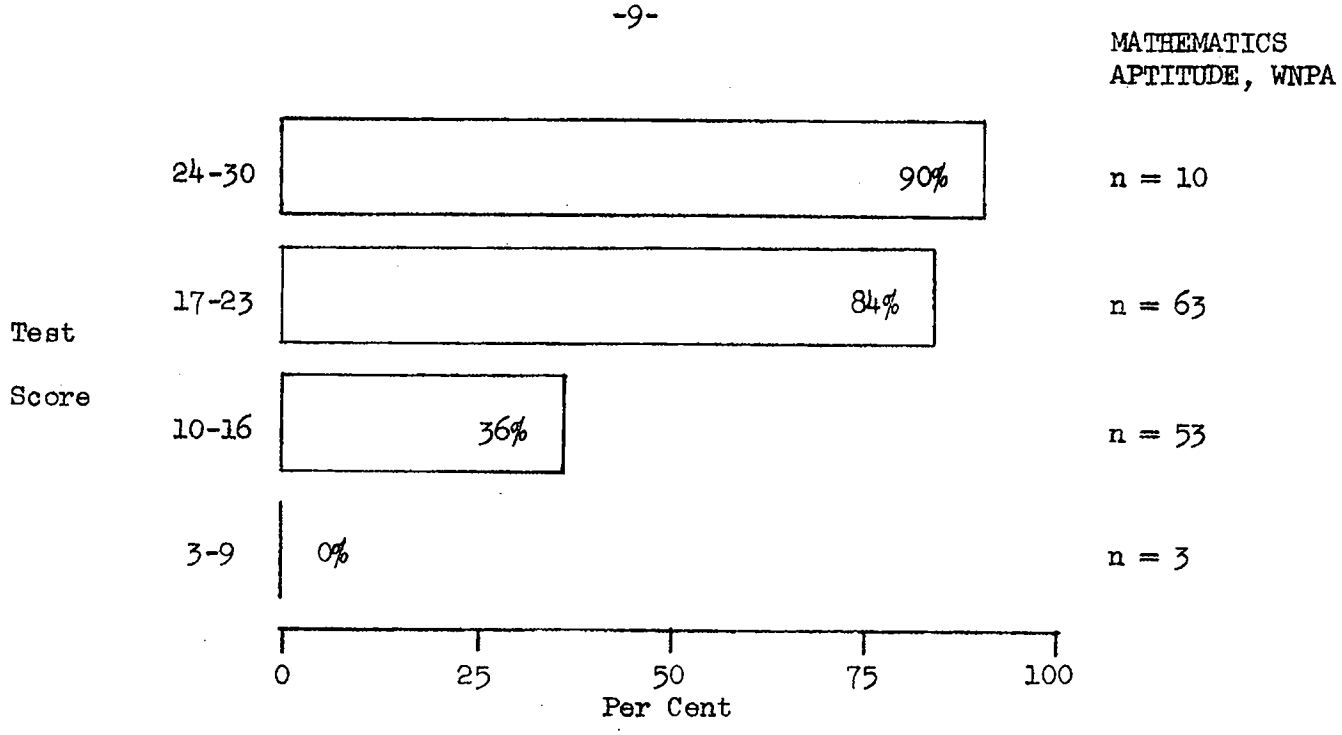

Figure 7. Per cent of students entering in 1950 in each of four score ranges on the Mathematics Aptitude Test, WNPA, with second-year quality-point ratios of 2.0 or above.
N = 129 Mean Test Score = 17.4 S.D. = 4.6 Test-Q.P.R. Correlation = .47

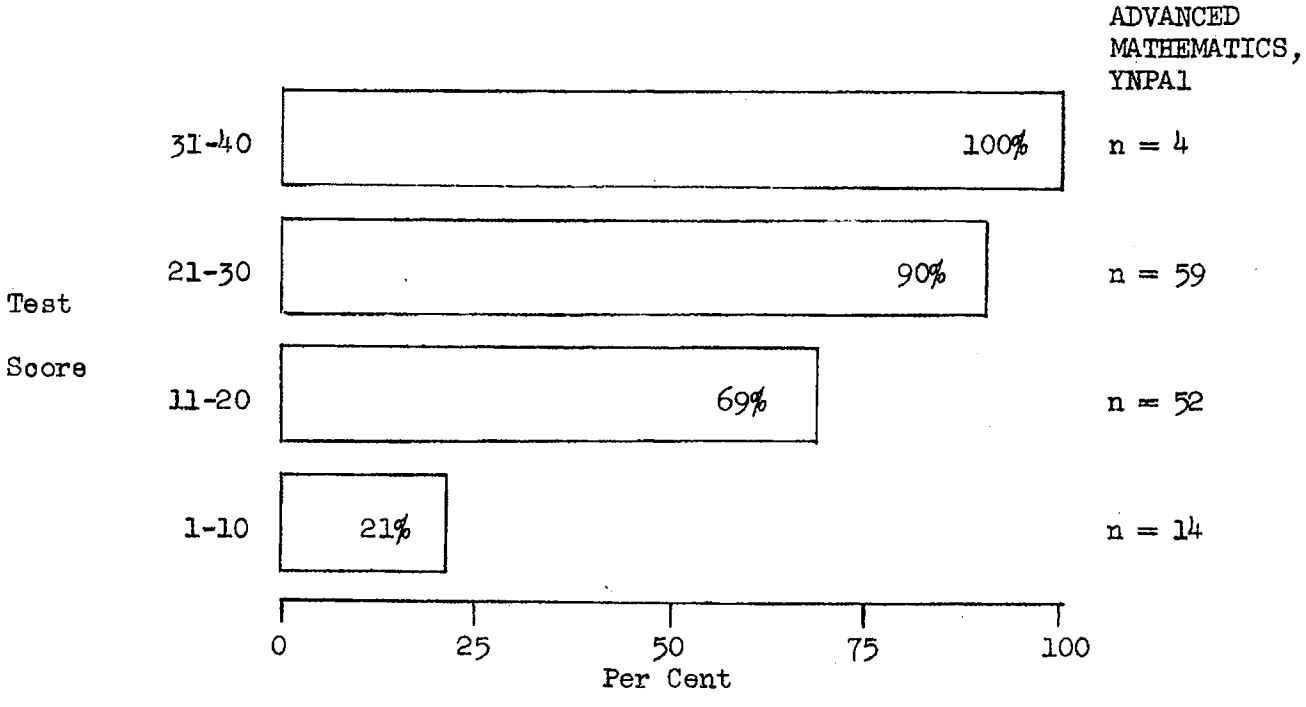

Figure 8. Per cent of students entering in 1950 in each of four score ranges on the Advanced Mathematics Test, YNPA1, with second-year quality-point ratios of 2.0 or above.
N = 129 Mean Test Score = 19.9 S.D. = 6.9 Test-Q.P.R. Correlation = .58

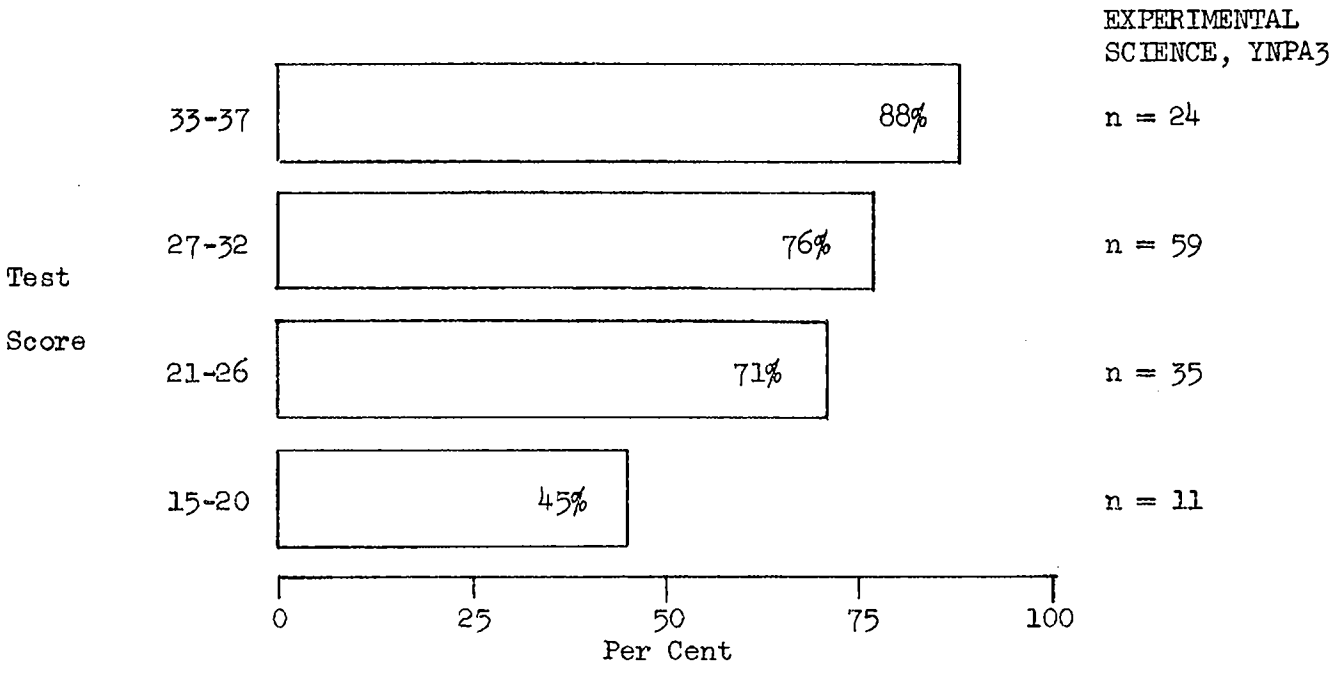

Figure 9. Per cent of students entering in 1950 in each of four score ranges on the Experimental Science Test, YNPA3, with second-year quality-point ratios of 2.0 or above.
N = 129 Mean Test Score = 27.8 S.D. = 4.6 Test-Q.P.R. Correlation = .37

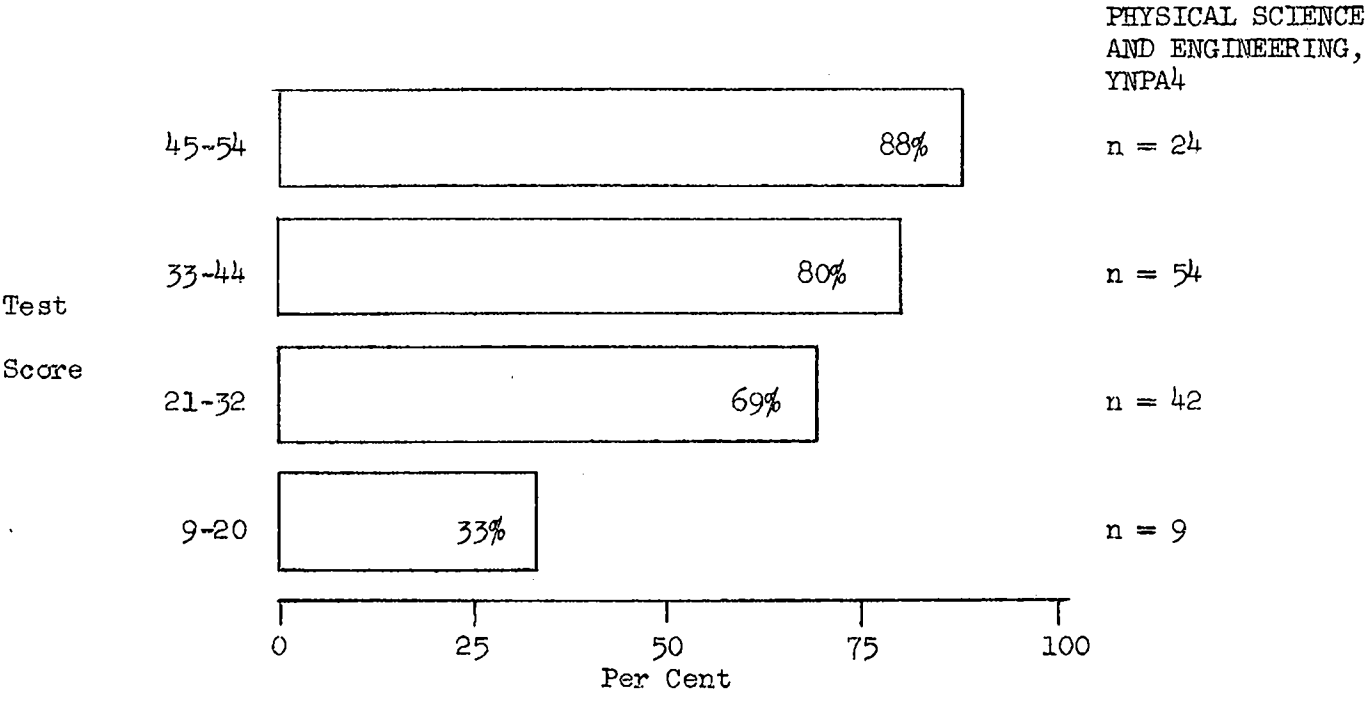

Figure 10. Per cent of students entering in 1950 in each of four score ranges on the Physical Science and Engineering Test, YNPA4, with second-year quality-point ratios of 2.0 or above.
N = 129 Mean Test Score = 35.2 S.D. = 9.6 Test-Q.P.R. Correlation = .40

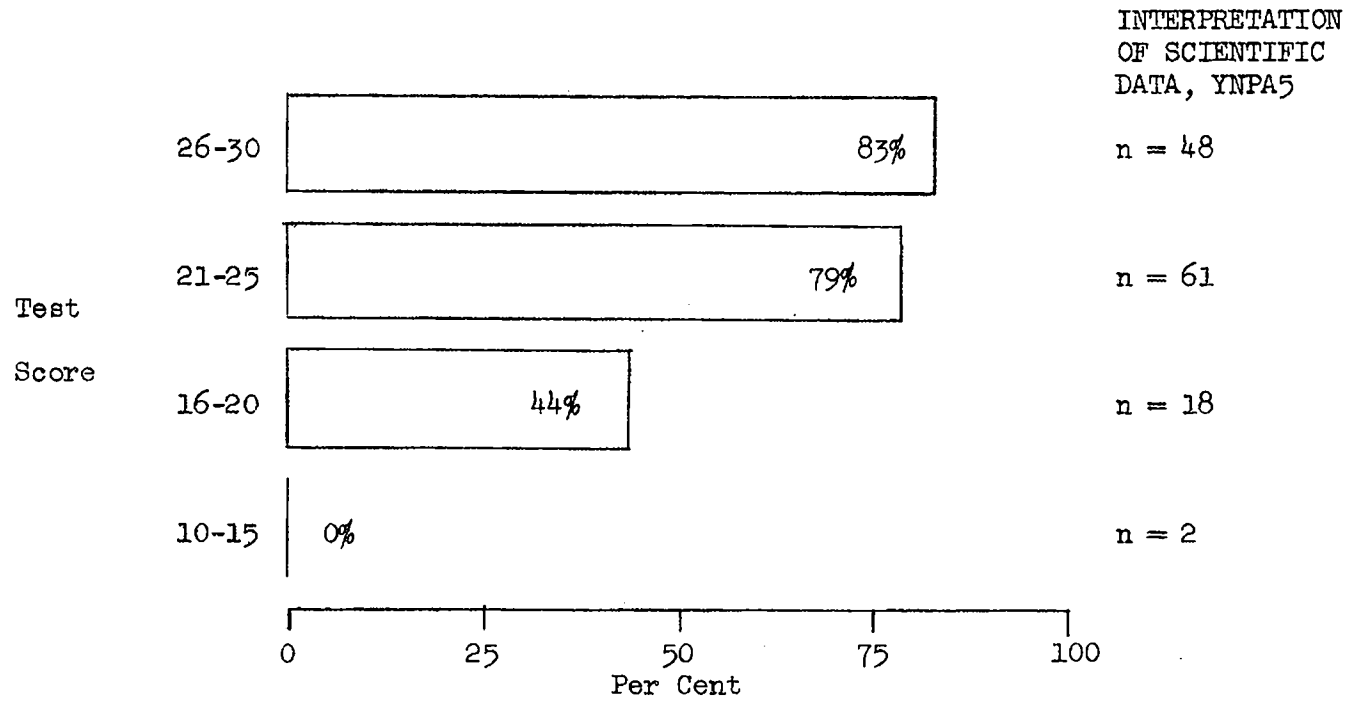

Figure 11. Per cent of students entering in 1950 in each of four score ranges on the Interpretation of Scientific Data Test, YNPA5, with second-year quality-point ratios of 2.0 or above.
N = 129 Mean Test Score = 24.1 S.D. = 3.4 Test-Q.P.R. Correlation = .41

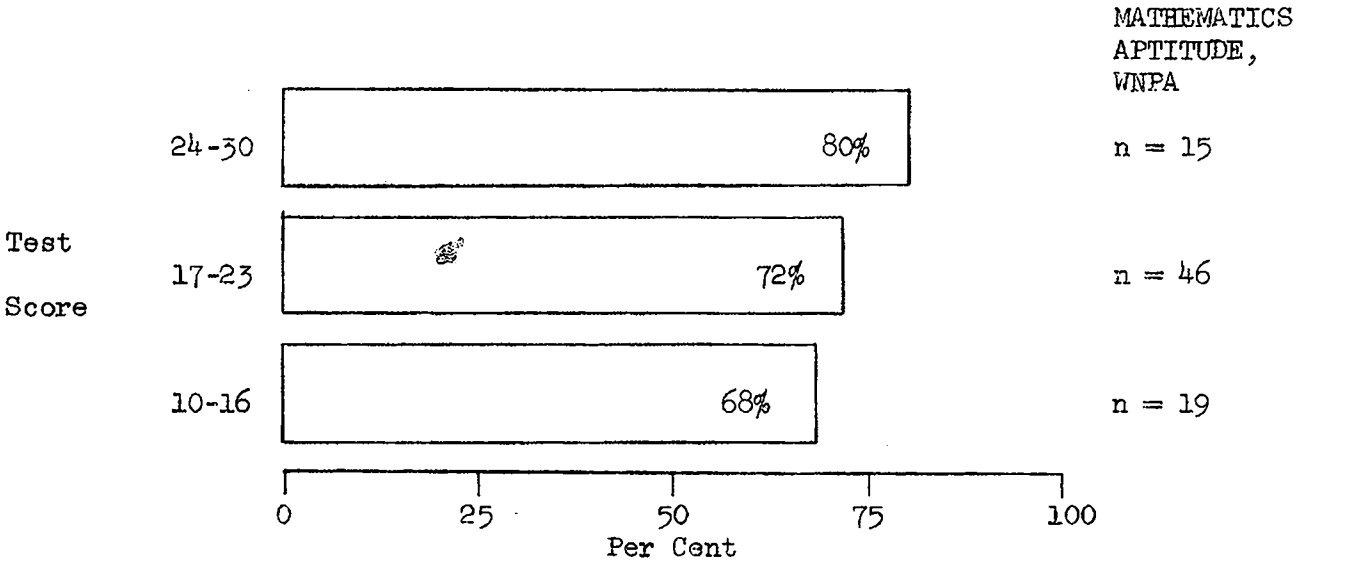

Figure 12. Per cent of students entering in 1951 in each of three score ranges on the Mathematics Aptitude Test, WNPA, with first-year quality-point ratios of 2.0 or above.
N = 80 Mean Test Score = 19.9 S.D. = 4.3 Test-Q.P.R. Correlation = .20

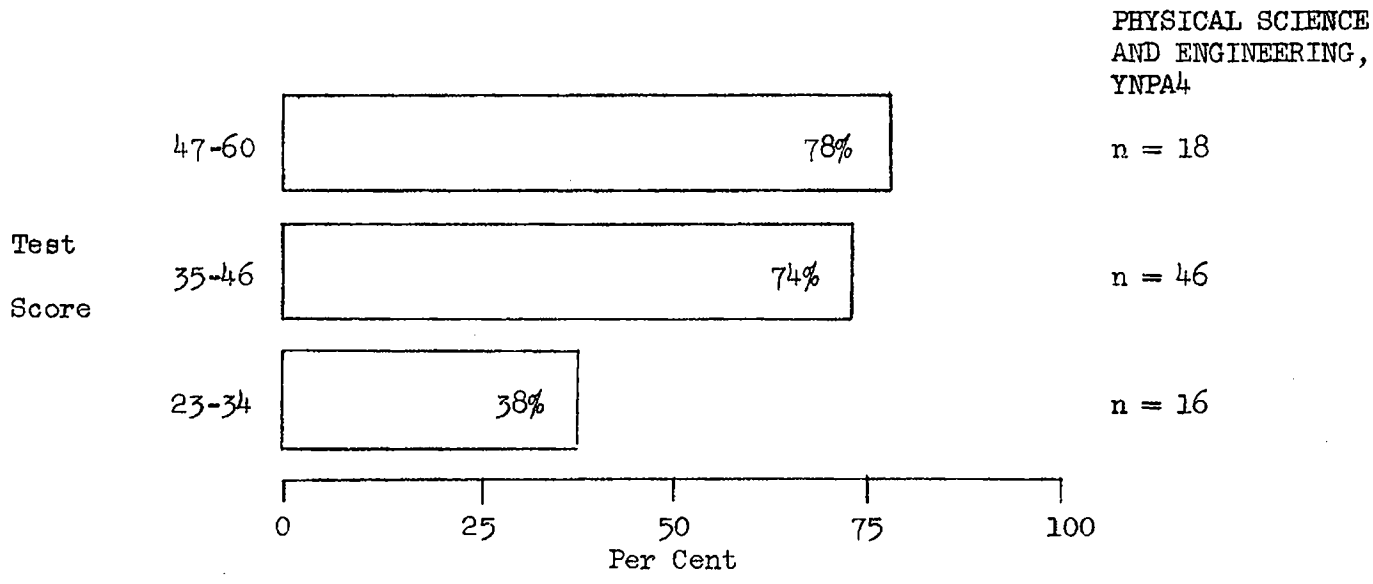

Figure 13. Per cent of students entering in 1951 in each of three score ranges on the Physical Science and Engineering Test, YNPA4, with first-year quality-point ratios of 2.0 or above.
N = 80 Mean Test Score = 40.5 S.D. = 7.6 Test-Q.P.R. Correlation = .21

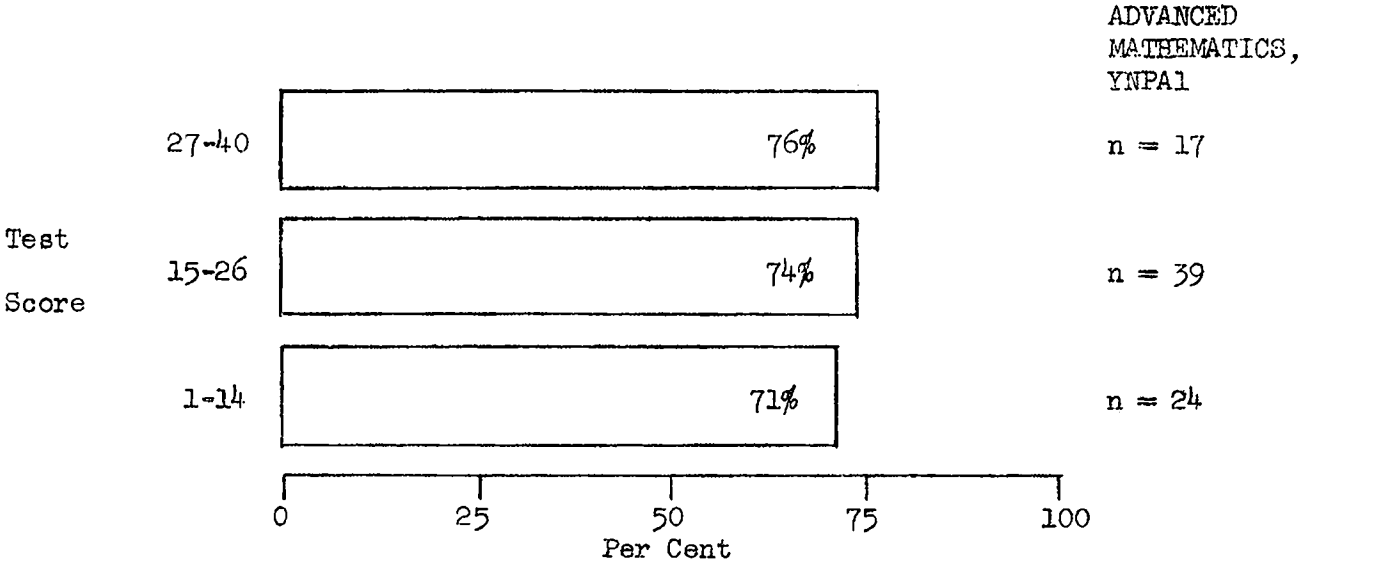

Figure 14. Per cent of students entering in 1951 in each of three score ranges on the Advanced Mathematics Test, YNPA1, with first-year quality-point ratios of 2.0 or above.
N = 80 Mean Test Score = 19.3 S.D. = 7.8 Test-Q.P.R. Correlation = .19